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ECONOMIC INTELLIGENCE REPORT 2

AMUR SHIPYARD No. 199 IN KOMSOMOLSK, KHABAROVSKIY KRAY

CIA/RR 43
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FOREWORD

This report on Amur Shipyard No. 199 is one of a series of Soviet shipyard studies made in an effort to better assess the capabilities of the Soviet shipbuilding industry.

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AMUR SHIPYARD No. 199, IN KOMSOMOLSK, KHABAROVSKIY KRAY*

Summary and Conclusions

Amur Shipyard No. 199, in Komsomolsk, Khabarovskiy Kray, is the most important shipbuilding yard in the eastern coastal region of the USSR.

The design and arrangement of facilities indicate greater emphasis on construction than on repair. Naval vessels, including submarines, ranging in size from small coastal craft up to and including cruisers, can be built. Final outfitting of oceangoing vessels is usually accomplished at Vladivostok or some other coastal shipyard.

Based on one 8-hour labor shift, the shipyard is capable of annually producing 30,400 standard displacement tons (SDT)** of naval construction, which is equivalent to 1 cruiser, 4 destroyers, 4 ocean patrol submarines, and 12 submarine chasers. Should the shipyard be devoted exclusively to the production of merchant ships, 55,400 gross register tons (GRT)*** could be produced annually. This tonnage is equivalent

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* The estimates and conclusions contained in this report represent the best judgment of the responsible analyst as of 1 August 1954.

** Standard displacement of a surface vessel is the displacement (in tons of 2,240 pounds) of the vessel, complete, fully manned, engined, and equipped ready for sea, including all armament and ammunition, equipment, outfit, provisions and fresh water for crew, miscellaneous stores, and implements of every description that are intended to be carried in war, but without fuel or reserve feed water on board. Standard displacement of a submarine is the surface displacement and is similar to the standard displacement of a surface vessel but without lube oil, fresh water, or ballast water of any kind on board.

*** Gross register tonnage is a measure wherein the entire internal cubic capacity of the vessel is expressed in register tons (100 cubic feet to the ton). Certain spaces are not included in the measurement, such as peak tanks and other tanks of water ballast, open forecastle, bridge and poop, hatchway excess, certain light and air spaces, anchor gear, steering gear, wheelhouse, galley, cabins for passengers, and other minor spaces specified by law.

to 9 medium-size cargo vessels. These estimates are based on a probable construction program utilizing all facilities rather than construction of the maximum size vessel in each building dock.

Repair is mainly of river vessels, both naval and merchant, during the winter months when the Amur River is frozen, and represents a relatively minor part of the shipyard's work.

Capital and technological improvements since World War II have combined to probably double the plant's productive capability. Despite its distance from the coast and the short navigation period in the Amur River, the improvements made after World War II indicate the intention of maintaining this shipyard as the principal shipbuilding center in the Far East.

The shipyard is well developed and coordinated. Any economic weakness derives from its physical location and concomitant weather conditions. Propulsion and heavy machinery can be obtained only from Western USSR, which requires a haul of 4,500 to 5,750 miles over the Trans-Siberian railroad. The freezing of the Amur River for 6 months of the year tends to restrict production.

The present number of employees is not known. A total shipyard force (direct and indirect)* of 14,400 employees would be required to produce the 30,400 SDT of naval construction; whereas a total shipyard force (direct and indirect) of only 5,900 employees would be required to produce the 55,400 GRT of self-propelled merchant cargo ship construction. Should a production program be instituted requiring a force of about 15,000 employees, it is believed that such a force could be made available.

I. Name and Location.

Amur Shipyard No. 199 is situated on the northwest bank of the Amur River, southeast of and adjoining the city of Komsomolsk,

* Direct employees are personnel whose labor is directly chargeable to a specific ship; indirect employees are personnel engaged in management, clerical work, maintenance, and the like.

Khabarovskiy Kray, in Economic Region XII.* The plane coordinates are latitude 50°33'N, longitude 137°02'E.

Komsomolsk is located on the left bank, going downstream, of the Amur River about 345 nautical miles above its mouth. In the Amur River a minimum depth of 16 feet is maintained by dredging. At Komsomolsk the Amur is not affected by tides, but flood waters, usually in September, cause a rise of about 14 feet in the water level. The mouth of the Amur River is closed by ice from about the first of November to about the end of May, resulting in a navigation period of about 150 days. 1/** Between the last week of October and the middle of March the average daily temperature is below freezing, about 110 to 120 days being below 14°F. 2/ A low of -40°F has been recorded. 3/

Komsomolsk is on a single-track rail line (5'-gage) extending northeastward from Dezhnevka, a station 23 miles west of Khabarovsk on the Trans-Siberian railway. A second single-track line, completed after World War II, also connects Komsomolsk to the Trans-Siberian railroad at Izvestkovaya, via Chekunda and Duki. 4/ A single-track line extends eastward from Pivan, opposite Komsomolsk on the right bank of the Amur River, to Sovetskaya Gavan. The Amur River is crossed by a diesel-operated railroad car ferry connecting Komsomolsk with Pivan. 5/ It is possible that a rail line now connects Komsomolsk with Nikolayevsk, following generally the Amur River valley. 6/

The buildings in the shipyard are widely separated, 200 to 300 yards apart in some cases. The total area of the shipyard, which may include some living quarters, covers approximately 200 acres.

II. History.

Komsomolsk was chosen as the location for a new industrial development shortly after the Manchurian incident, when it became evident that Japan might be able to cut the Trans-Siberian railroad. There was need for the rapid industrialization of an area in the

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Maritime Provinces that would make them independent of Western USSR industry. 7/

The building of the Amur shipyard began in 1932. Production got underway around 1937, at which time the first phase of construction was completed at a reported cost of 230 million rubles. 8/

Little improvement was made to the shipyard during World War II. Following the war the shipyard was expanded and improved by replacing wooden with masonry structures, erecting new shops and covered shipbuilding ways, and improving facilities and techniques. 9/

In 1947 the Soviet authorities allotted 15,000 square meters of dwelling space to be built for the workers in the shipyard. These quarters were to be equipped with electricity, hot water, and gas. 10/ These quarters consist of barracks, apartments, and individual houses and will probably house about 2,700 people.

Despite the lack of specific data on shipbuilding facilities, the Amur shipyard is believed to be a well balanced and coordinated building yard, comparable to the older shipyards in Western USSR.

III. Organization.

In 1948 the shipyard was reported to be under the direct control of the Ministry of Shipbuilding (MSP-Ministerstvo sudostroitel'noy promyshlennosti). 11/ In the reorganization of March 1953 the Ministry of Shipbuilding was absorbed into the Ministry of Transport and Heavy Machine Building. In the reorganization of April 1954, the Ministry of Shipbuilding re-emerged and is again probably in direct control of the shipyard.

IV. Importance.

The Soviet Navy, required by the exigencies of geography to maintain a separate fleet for each coastal region, has developed basing, shipbuilding, and repairing facilities for each fleet. The Amur shipyard is the principal shipbuilding yard for the Soviet Pacific Fleet, and the largest shipbuilding center in far eastern USSR. While there are other important building yards in the far eastern USSR, none have been developed to a comparable degree of self-sufficiency. 12/

V. Buildings and Facilities.

[redacted] 50X1

[redacted] It 50X1 is believed that the shipyard contains machine shops and hull fabrication and assembly shops in addition to those shown on the chart showing the layout of the shipyard (see Fig. 1).* 13/

For the most part the buildings are of permanent construction, having masonry walls, metal and composition roofs, steel supported roof structures and steel overhead crane supports. 14/

The shipyard is protected on the land side by a fence about 2 meters high, which has been variously reported as being made of wood, barbed wire, electrified wire, and wood topped with barbed wire. All entrances are guarded by armed guards, and entrance is by pass only. 15/

Intrayard transportation is chiefly by railroad. Trackage is generally Soviet standard gage, so that freight cars may be shunted directly into shops and shipbuilding ways without transshipment of freight. 16/ The equipment is listed as reported, even though it may be considered inadequate to perform the operations indicated by the designated use of the buildings.

Transformer Station (1).**

The transformer station contains 3 transformers rated at 1,000 kilowatts per hour. Power comes from plant (36). 17/

Saw Mill (2).

Logs are rafted into the area and floated to the shore near the saw mill. The logs are then dragged along skids to the saw mill by winch and cable. 18/

* Fig. 1 follows p. 6.

** The numbers and letters in parentheses correspond to those found on Fig. 1. Certain numbers have been omitted from this discussion, because nothing is known about the buildings they identify other than their probable use.

Forge and Machine Shop (15).

The forge and machine shop is divided into 3 bays. The 2 outside bays are 2 stories high and contain offices and machine shops. The center bay is clerestory lighted by skylights. The center bay contains the forge shop and is equipped with 6 steam hammers, 6 oil fired reheating furnaces, stamping machines, overhead traveling cranes, and other equipment. 19/

Machine Shop (16).

This machine shop contains a large gear cutting machine and large lathes probably capable of machining propeller shafting. This shop also machines propeller castings and manufactures small parts. 20/

Machine Shop (18).

This machine shop is reported to manufacture bolts and rivets. It contains a number of small lathes, boring machines, grinders, punch presses, polishing machines, small shapers and drill presses. 21/

Foundry (25).

This foundry is equipped with blast furnaces, oil-fired tilting type furnaces, and 4 electric furnaces of 5-ton capacity each. It contains a moulding and casting section, and a casting dressing section. Both ferrous and nonferrous castings are produced. This foundry is reported to be capable of casting propellers up to 13 feet in diameter. 22/

Machine Shops (39, 40, and 41).

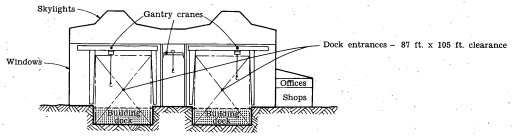
These machine shops are equipped with large and medium size lathes, shearing machines, shapers, boring machines, drill presses, milling machines, reheating furnaces, overhead traveling cranes, and other equipment. These shops are reported to produce camshafts, water pipe bushings, piston sleeves and valves, connecting pins, railroad car wheels and axles, connecting rod bearings, ball bearing casings, spiral gears, pins, and various size bolts. 23/

U.S.S.R.

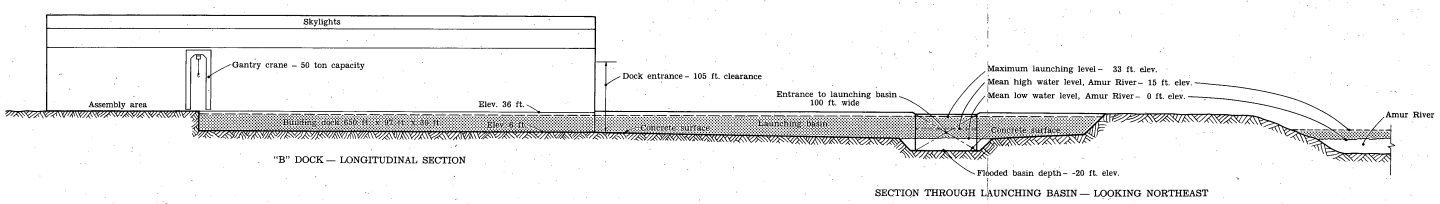
AMUR SHIPYARD NO. 199
KOMSOMOL'SK

"B" BUILDING DOCK AND LAUNCHING BASIN - SECTIONS

("A" AND "C" DOCK SIMILAR)

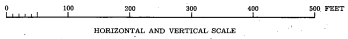


"B" DOCK — TRANSVERSE SECTION



"B" DOCK — LONGITUDINAL SECTION

SECTION THROUGH LAUNCHING BASIN — LOOKING NORTHEAST



HORIZONTAL AND VERTICAL SCALE

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Hull Fabrication Shop (42).

This shop is the principal hull fabrication and assembly shop. It is equipped with heavy plate shears, planers, plate bending rolls, oxy-acetylene cutting torches, punch presses, brakes, electric welding machines, boring machines, reheating furnaces, bending slab, forge, and pneumatic hammers, and other equipment. The building is divided into 3 bays. The two northern shop bays are clerestory and lighted by skylights. The southern bay, which is 2 stories high, is divided into small shops and offices on the first floor and probably has a mold loft on the second floor. 24/

Pump House (60).

This building is reported to house the pumps for filling and emptying the launching basin (61). 25/

Launching Basin (61a and 61b).

The bottom of the shallower section of the basin (61a) is about 38 feet below the ground level, and the bottom of the deeper section (61b) is about 58 feet below the ground level. The sides and bottom of both sections are surfaced with concrete. 26/ The shallower section (61a) is normally dry, and its bottom slopes slightly downward from the building docks to the deeper section (61b), which is normally flooded to a depth of about 20 feet. The water level of the deeper section (61b) is not permitted to rise above this low level, except during controlled operations of launching or docking of vessels.

The purpose of this basin (61) is primarily to launch vessels built in the building docks [A, B, and C]. Upon the completion of a vessel in any one of the building docks the following launching procedure is followed: (1) the watertight gate to the building dock is opened, (2) the watertight gate (62) between the launching basin and the inlet is closed, (3) the basin (61) and the building dock are flooded, by pumps (60), to a depth sufficient to float the vessel, (4) the vessel then is moved out of the building dock to a position over the deeper section (61b), and (5) the launching basin then is drained, the gate (62) removed, and the vessel moved out of the launching basin into the inlet.

The vessels are docked by reversing the launching procedure. The number of vessels that can be floated in the shallower section of the

launching basin limits the number of vessels launched or docked at any one time.

Watertight Gate (62).

This gate is estimated to be 100 feet long by 56 feet high. 27/

Quay and Pier (63 and 64).

These facilities are used very little for fitting out new construction. Several mobile cranes operate on the quay and pier. 28/ The depth of water alongside is about 18 feet. 29/

Covered Building Docks (A, B, and C).*

Buildings A and B have been in service since before 1943. Building C was constructed after World War II, and is believed to be operational. All are of masonry and steel construction. 30/ A cross section of building dock B is shown in Fig. 2.** Docks A and C are similar. These buildings are heated so that work can proceed during the winter months uninterrupted by unfavorable weather. 31/

There are estimated to be a total of 8 watertight concrete building docks. The 4 docks in building A and the 2 in building C are estimated to be 480 feet long by 80 feet wide by 24 feet deep. The 2 in building B are estimated to be 650 feet long by 97 feet wide by 30 feet deep. The entrance to each dock in A building is estimated to be 82 feet high by 70 feet wide; in B building 105 feet high by 87 feet wide; and in C building, 120 feet high by 70 feet wide.

Each dock is formed on 3 sides by a watertight concrete wall. The fourth side or entrance is formed by a watertight gate. Each dock may be flooded singly, or all docks may be flooded simultaneously. 32/ As the docks are of the graving type, the assembly area is level with the top of the dock walls. Railroad tracks that connect with the various shops and the main lines enter each assembly area. Material is moved from railroad cars and assembly area to the building docks by means of gantry cranes. The lifting capacity of each of these cranes is reported to be about 50 tons. 33/

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** Fig. 2 follows p. 8.

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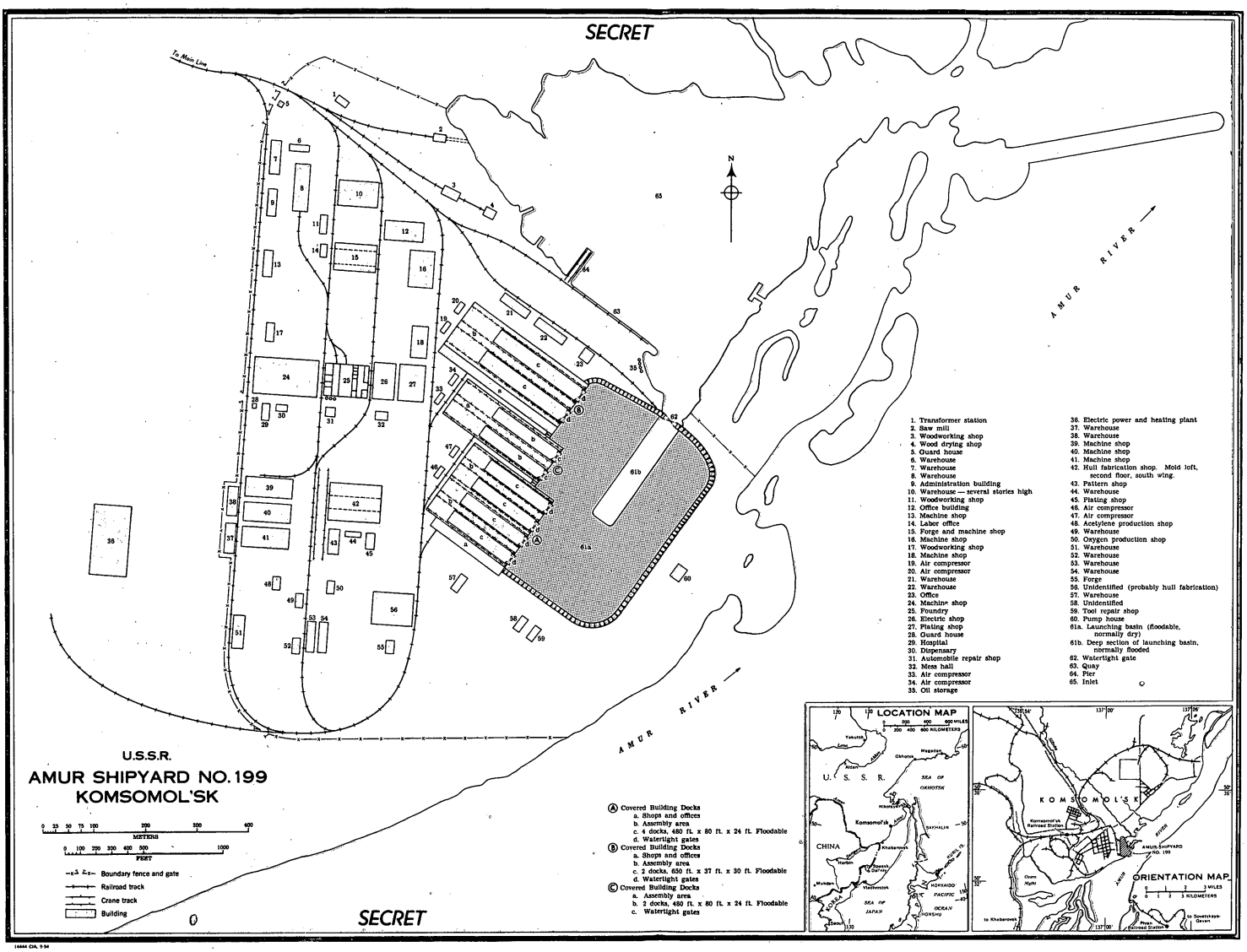

1. Transformer station
2. Saw mill
3. Woodworking shop
4. Wood drying shop
5. Guard house
6. Warehouse
7. Warehouse
8. Warehouse
9. Administration building
10. Warehouse — several stories high
11. Woodworking shop
12. Office building
13. Machine shop
14. Labor office
15. Forge and machine shop
16. Machine shop
17. Woodworking shop
18. Machine shop
19. Air compressor
20. Air compressor
21. Warehouse
22. Warehouse
23. Office
24. Machine shop
25. Foundry
26. Electric shop
27. Plating shop
28. Guard house
29. Hospital
30. Dispensary
31. Automobile repair shop
32. Mess hall
33. Air compressor
34. Air compressor
35. Oil storage
36. Electric power and heating plant
37. Warehouse
38. Warehouse
39. Machine shop
40. Machine shop
41. Machine shop
42. Hull fabrication shop. Mold loft, second floor, south wing.
43. Pattern shop
44. Warehouse
45. Plating shop
46. Air compressor
47. Air compressor
48. Acetylene production shop
49. Warehouse
50. Oxygen production shop
51. Warehouse
52. Warehouse
53. Warehouse
54. Warehouse
55. Forge
56. Unidentified (probably hull fabrication)
57. Warehouse
58. Unidentified
59. Tool repair shop
60. Pump house
61a. Launching basin (floodable, normally dry)
61b. Deep section of launching basin, normally flooded
62. Watertight gate
63. Quay
64. Pier
65. Inlet

Ⓐ Covered Building Docks
a. Shops and offices
b. Assembly area
c. 4 docks, 480 ft. x 80 ft. x 24 ft. Floodable
d. Watertight gates

Ⓑ Covered Building Docks
a. Shops and offices
b. Assembly area
c. 2 docks, 650 ft. x 37 ft. x 30 ft. Floodable
d. Watertight gates

Ⓒ Covered Building Docks
a. Assembly area
b. 2 docks, 480 ft. x 80 ft. x 24 ft. Floodable
c. Watertight gates

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Annex a to buildings A and B contain small shops, administrative, and engineering offices. 34/

Floating Cranes.

A 50-ton floating crane serves both the port and the shipyard. 35/

VI. Production.

Accurate data on the production of ships or the production of producer and consumer goods by the numerous associated shops are not available. The largest vessels known to be produced to date were the Kirov class heavy cruisers, Kalinin and Kaganovich, built during the early part of World War II. Other oceangoing naval vessels produced during World War II and in the years following, include Artillerist class submarine chasers, Bird class coastal destroyers, and Otlichnyy and Skoryy class destroyers. 36/

Submarines were reported to have been assembled in the shipyard from prefabricated sections built in Western USSR and shipped east over the Trans-Siberian railroad. 37/

Because of the small entrance to the building docks, the low overhead clearance of the gantry cranes in the buildings housing the docks, the relatively inadequate fitting out quays and piers, and the shallowness of the Amur River, vessels of destroyer size and larger are probably fitted out at Vladivostok. 38/ The amount of work done at Vladivostok is relatively small because all deckhouses, armament, and all propulsion machinery are installed at the Amur shipyard. 39/

River patrol vessels, small oil tankers and barges have been constructed in the shipyard since World War II. 40/

In 1945-46, 2 railroad car ferries were built. These car ferries were put into operation in the Amur River between Komsomolsk and Pivan. 41/ River vessels and car ferries are completely fitted out and operational when delivered by the shipyard.

Repair of vessels is believed to be largely confined to river patrol and merchant river vessels. [redacted] 50X1 50X1 Immediately before the Amur River freezes, vessels to be repaired are docked on the concrete floor of the launching basin (61a). Repairs to both hull and machinery are carried out during the winter months. 42/

Shipyard shops, in addition to supporting vessel construction and repair, manufacture both producer and consumer goods. Among the items produced are spare parts for agricultural machinery, spare parts for tractors, pontoons, railroad car wheels and axles, machinery, spare parts for machinery, furniture, plated metal beds, electric hot plates and irons, and plated table ware. 43/

VII. Labor.

Reports as to the number employed in the shipyard through 1949 range from a low of 1,500 employees 44/ to a high of 15,000 employees working three shifts. 45/ During this period the shipyard was engaged in ship production and capital improvements. 46/ A breakdown of the number engaged in each activity cannot be made, and reports of the labor situation at a later date than 1949 are not available.

In the immediate postwar years prisoners of war were used as building construction workers and laborers. Few, if any, were used in production work. 47/ Some shops and the 'secret dock' (b) were reported working three labor shifts, while other shops usually worked only one labor shift. 48/

It is estimated that a total of 14,400 employees, would be required to produce the 30,400 SDT of naval construction listed in Table 2 on a one eight-hour shift basis. It is believed that the administrative and other nonproductive (indirect) employees constitute about 25 percent of this total. This percentage compares favorably with US practice. Therefore, it is estimated that 10,800 employees, or 75 percent of the total, are productive (direct) labor. Should such a production program be undertaken, this labor force could probably be made available.

To produce the 55,400 GRT of merchant vessels listed in Table 4 would require a total of 5,900 employees, of which 4,400 employees would be productive (direct) labor.

It is assumed that the productivity of the free Soviet shipyard worker is comparable to that of the US worker. Therefore, a factor of relative efficiency was not used. However, if forced labor is used in production shops and in shipbuilding, it is doubtful that the estimated production rates could be met with the estimated total number of employees.

There are three technical schools in Komsomolsk -- one each for architecture, industry, and shipbuilding. In 1945 the shipbuilding school was under the direction of Litvinenko. 49/

VIII. Sources of Power and Material.

Data indicating the amount of raw, semifinished, or finished material received by the shipyard are not available.

The port of Komsomolsk is of little importance. 50/ Probably the principal import over the Amur River is lumber, which is received mainly in the form of log rafts. 51/ The bulk of freight moved into the shipyard is by rail. 52/

Most of the foundry pig iron, steel for forgings, steel plates, and shapes are probably obtained from the Amur Steel Plant at Komsomolsk. 53/

Propulsion and other heavy machinery is probably shipped from plants in Leningrad and Sverdlovsk; other components come from Moscow and Nikolayev. It is probable that some lighter components may be obtained from nearby plants in Semenovka, Khabarovsk, and Vladivostok. 54/

Electric power and steam heat are obtained from the large power and heating plant (36) adjoining the shipyard on the west. The total rated capacity of the several electric power plants in Komsomolsk is about 140,000 kw. 55/ The estimated consumption of the shipyard is 57 million kwh per year, with a coincident peak load of 13,000 kw, based on a 50-percent load factor. The power plants in Komsomolsk are not known to be tied in with any major grid system. 56/

IX. Capabilities and Vulnerabilities.

A. Capabilities.

The development of the shipyard indicates greater emphasis on shipbuilding than on ship repair. Minor repairs can be made to vessels docked on the floor of the launching basin and at the quay and pier at location 63 and 64 on the shipyard chart. Large vessels requiring major repairs can be docked in the building docks only after the dismantling of masts, antennae, and possibly some deck superstructure.

Naval vessels up to and including Kirov class cruisers have been built. Submarine assembly has been reported. Postwar capital improvement to shops and shipbuilding docks (probably the enlargement of some existing docks) and the building of additional shipbuilding docks have probably more than doubled the productive capability of the shipyard since World War II.

The shops have been developed to support adequately shipbuilding, including submarine production, of types and sizes up to the limitations set by the size of the building docks. Ship production is estimated on the basis that the following work is done within the shipyard: (1) all hull steel is fabricated and assembled; (2) the production and machining of all light and heavy castings and forgings, including propeller shafting, and propellers up to and including those of destroyer size; (3) all machinery and naval ordnance is assembled and installed. The lack of significant improvement of fitting out facilities indicates that all work on oceangoing vessels, not possible within the covered building docks, continues to be done in some coastal shipyard, probably Vladivostok. The shipyard has ample room for further expansion.

Based on a realistic appraisal of the support required by the Soviet Far Eastern Fleet, Table 1* presents a theoretical program for the concurrent construction of naval vessels in Amur Shipyard No. 199 that will utilize all known facilities. It is a probable program rather than one using the maximum size vessel each building dock could accommodate.

Based on the construction listed in Table 1, the Amur Shipyard is capable of producing 30,400 SDT annually. (See Table 2.)**

In the event that the shipyard should be devoted to the production of merchant vessels, the theoretical construction program of self-propelled oceangoing cargo ships, shown in Table 3***, could be built simultaneously. This program would occupy all known facilities. It is also a probable rather than a maximum tonnage construction program.

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* Table 1 follows on p. 13.
** Table 2 follows on p. 13.
*** Table 3 follows on p. 14.

Table 1

Theoretical Program for Concurrent Construction of Naval Vessels in Amur Shipyard No. 199

Location a/	Type	Class	Number of Vessels	Length (Feet)	Total Tonnage (SDT)
A	Destroyers	Skoryy	4 b/	420	12,000
B	Cruisers	c/	2		20,000
C d/	Submarines	W	4	250	4,800
	Subchasers	Artillerist	6	175	1,800
Total					38,600

a. On Fig. 1, which follows p. 6.
b. 1 destroyer in each of the 4 docks in building A.
c. The building docks are probably too small for the Sverdlov class. A 10,000-ton cruiser is used for estimating purposes.
d. Building C has two docks. 2 submarines and 2 subchasers can be built simultaneously in each dock.

Table 2

Estimated Annual Naval Vessel Capacity of Amur Shipyard No. 199 a/

Number of Vessels	Type	Class	Total Tonnage (SDT)
4	Submarines	W	4,800
12	Subchasers	Artillerist	3,600
1	Cruisers		10,000
4	Destroyers	Skoryy	12,000
Total			30,400

a. Based on the theoretical construction program shown in Table 1. See Appendix A, Methodology.

Table 3

Theoretical Program for Concurrent Construction of Self-Propelled Cargo Ships in Amur Shipyard No. 199

Location a/	Type	Number	Length (Feet)	Total Tonnage (GRT)
A	Cargo	4	450	25,600
B	Cargo	2	450	12,800
	Loggers	6 b/	130	2,100
C	Cargo	2	450	12,800
Total				53,300

a. On Fig. 1, which follows p. 6.
b. 1 cargo ship and 3 loggers can simultaneously be built in each dock in building B.

Based on the construction listed in Table 3, the possible annual production of merchant vessels in gross register tonnage is shown in Table 4.

Table 4

Estimated Annual Merchant Vessel Capacity of Amur Shipyard No. 199 a/

Number of Vessels	Type	Total Tonnage (GRT)
8	Cargo	51,200
12	Loggers	4,200
Total		55,400

a. Based on the construction program shown in Table 3. See Appendix A, Methodology.

Output in both naval and merchant tonnage may possibly be increased by increasing the number of hours of the one shift, the repetitious production of a single design, improving technological processes, and by apprentice training. Assuming no bottleneck in the supply of material, output may be increased by working additional shifts. However, it is doubtful that sufficient qualified engineering and supervisory personnel and skilled workmen could be made available to permit the additional shifts.

B. Vulnerabilities.

The shipyard has probably developed into a well coordinated plant. Its location, however, gives rise to economic hazards. Despite the industrialization of the Eastern USSR, main heavy machinery is obtainable only from Western USSR, some 4,500 to 5,750 miles away. Not only is a physical hazard involved, but transportation, principally over the Trans-Siberian railroad, adds considerably to the final cost of each end production.

Production of vessels is scheduled to suit climatic conditions. Launchings are limited to the 6-month period when the flooding of the building docks is not stopped by ice formation. It is difficult to schedule launchings at 6- to 12-month intervals, and as a consequence output is reduced.

The Amur shipyard, like the shipbuilding industry in general, conducts what may be classified as a fabricating type of operation. Therefore the chief economic problem lies in assuring a steady flow of raw materials and components produced by other industries.

APPENDIX A

METHODOLOGY

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The determination of the number and size of docks was difficult because the reported size ranged from 229 to 656 feet long and 50 to 98 feet wide. The reported number of buildings housing the docks ranged from 1 to 3, and the number of docks ranged from 2 to 7.

The reported length and width of the docks showed no consistent length-width ratio. It is assumed that Soviet engineers would design facilities, particularly graving docks, to suit the construction of principal types of merchant and naval vessels. With the exception of capital warships, the beam-length ratio of merchant vessels is greater than the beam-length ratio of cruisers and smaller warships. Assuming the maximum beam of medium sized oceangoing merchant vessels to be one-tenth the length plus 20 feet, and allowing 6 feet on each side for staging, the width of the docks is estimated at one-tenth the length plus 32 feet.

In computing the width and length of each dock the maximum reported dimension, with respect to the beam-length ratio, was used. In the case of the docks in building A, the reported maximum dimension was the 80 foot width. Using the formula, the length of each dock would be 480 feet. The cruisers Kalinin and Kaganovich were built in building B. The length of these vessels is about 630 feet. Using the reported dimension of 650 feet in length as the maximum dimension, the width of the dock is estimated at 97 feet.

The excavation for the docks in building C was reported to be about 500 feet long. This length compares favorably with the estimated length of the docks in building A. Therefore, it was concluded that building C housed 2 docks similar to those in building A.

The height of the entrance to the B docks was estimated on the basis of the reported state of completion of the cruiser Kaganovich when last observed in one of the building docks. The conning tower, main battery, deck houses, and all main propulsion machinery were in place at that time. Assuming that the stacks were installed before launching, the required clear height of entrance would be about 105 feet. Assuming a comparable state of completion for destroyers built in A docks, the estimated required clear height of entrance would be about 82 feet. Building C is reported to be higher than either A or B. Assuming that destroyers constructed in C docks would be completed within the dock, an estimated required clear height of entrance would be about 120 feet. The width of entrance is estimated to be 10 feet less than the width of the dock.

In computing the annual naval vessel capacity shown in Table 2, the following estimates and assumptions were made: (1) the necessary material, labor, and power would be available; (2) only one 8-hour labor shift would be employed; (3) vessels can be launched only during the 6-month period from May through October. It is apparent that the principal building period is during the winter months, with launchings scheduled during the summer months. It is believed that schedules would be set up so that the destroyers and submarines would be completed within 1 year, cruisers in 2 years, and subchasers possibly in 6 months, permitting 2 launchings each year. The time required to complete vessels in Vladivostok, or some other capital shipyard, is not included in the estimated completion time, and is considered not to affect the rate of construction at the Amur shipyard.

The estimates and assumptions made in calculating merchant tonnage were similar to those made for the calculation of naval tonnage: (1) the necessary material, labor, and power would be available; (2) only one 8-hour labor shift would be employed; (3) building schedules would be set up so that the cargo ships would be completed within 1 year, and the loggers possibly in 6 months, permitting 2 launchings each year. The cargo ships could not be completed within the building docks. The time required to complete the vessels in Vladivostok or some other coastal shipyard has also been disregarded in this estimate.

In calculating the number of direct employees, the figures in Table 5* showing the number of man-hours required to construct certain types of naval vessels in the US were used.

* Table 5 follows on p. 19.

Table 5

Man-Hours Required to Construct Naval Vessels in the US

Type	Tonnage (SDT)	Man-Hours per SDT
Submarine	1,138	966
Subchaser	240	833
Cruiser (Light)	10,000	640
Destroyer	2,600	830

The working year (man-year) in the USSR is 2,224 working hours, that is, 365 days minus 87 days for regular days off, holidays, absenteeism, and vacations, leaving 278 days; 278 days at 8 hours per day equals 2,224 man-hours. On this basis, and using the man-hours per SDT from Table 5, direct labor to yield the possible production of 30,400 SDT of naval construction is shown in Table 6.

Table 6

Estimated Number of Direct Employees Required for Theoretical Naval Vessel Construction Program a/

Number of Vessels	Type	Total Tonnage (SDT)	Direct Employees
4	W Class Submarines	4,800	2,085
12	Artillerist Class Subchasers	3,600	1,348
1	10,000-Ton Light Cruiser	10,000	2,878
4	Skoryy Class Destroyers	12,000	4,478
Total		30,400	10,789

a. Shown in Table 2.

In calculating the manpower required to construct the merchant vessel tonnage, a US factor of 175 man-hours required to produce one GRT of cargo ship construction was used. Since the estimate of merchant vessel tonnage is largely based on cargo class vessels, only one rate was used.

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